1. A method of producing a high strength metal part within a die cavity defined by a die set mounted on a vertical die cast press including a shot chamber having a generally vertical axis and a shot piston movable axially within the chamber, the method comprising the steps of heating a solid metal to form a molten metal, directing the molten metal into the shot chamber, cooling the molten metal within the shot chamber to within a temperature range forming a semi-solid slurry having a globular and generally non-dendritic microstructure, moving the shot piston upwardly to transfer the semi-solid slurry from the shot chamber through a gate opening into the die cavity, and allowing the semi-solid slurry to solidify within the die cavity to form the metal part.

2. A method as defined in claim 1 and including the step of adding a grain refiner to the metal directed into the shot chamber.

3. A method as defined in claim 1 wherein the molten metal is a permanently grain refined alloy.

4. A method as defined in claim 1 including the steps of forming an annular entrapment recess above the shot chamber, and trapping an outer portion of the semi-solid slurry within the shot chamber within the entrapment recess in response to upward movement of the shot piston.

5. A method as defined in claim 1 wherein the molten metal is cooled within the shot chamber to a temperature range which produces a range of 40% to 60% solid to form the semi-solid slurry.

6. A method as defined in claim 1 wherein the molten metal is A356 aluminum alloy and is cooled within the shot chamber to a temperature within the range of 570°C to 590°C to form the semi-solid slurry.

7. A method as defined in claim 1 and including the step of directing the molten metal into a second shot chamber receiving a second shot piston, interchanging the second shot chamber and piston with the first shot chamber and piston after the semi-solid slurry is transferred from the first shot chamber into the die cavity, and cooling the molten metal within the second shot chamber to within the temperature range forming the semi-solid slurry.

8. A method as defined in claim 1 wherein the molten metal is cooled within a shot chamber having a diameter larger than its axial length.

9. A method as defined in claim 1 wherein the molten metal is cooled to form a semi-solid slurry within a shot chamber having a diameter of at least six inches.

10. A method as defined in claim 1 wherein the molten metal is A356 aluminum alloy and is cooled within the shot chamber to a temperature within the range of 570°C to 590°C to form the semi-solid slurry.

11. A method as defined in claim 1 wherein the gate opening is located to receive the semi-solid slurry within only a center portion of the shot chamber and to avoid receiving more solid slurry within an outer portion of the shot chamber.

12 A method of producing a high strength aluminum alloy part within a die cavity defined by a die set mounted on a vertical die cast press including a shot chamber having a generally vertical axis and a shot piston movable axially within the chamber, the method comprising the steps of heating an ingot of aluminum alloy to form a molten aluminum alloy having a grain refiner, directing the molten aluminum alloy into the shot chamber, cooling the molten aluminum alloy within the shot chamber to within a temperature range forming a semi-solid slurry having a globular and generally non-dendritic microstructure, moving the shot piston upwardly to transfer the semi-solid slurry from the shot chamber through a gate opening into the die cavity, and allowing the semi-solid slurry to solidify within the die cavity to form the aluminum alloy part.

13. A method as defined in claim 12 including the steps of forming an annular entrapment recess above the shot chamber, and trapping an outer portion of the semi-solid slurry within the shot chamber within the entrapment recess in response to upward movement of the shot piston.

14. A method as defined in claim 12 wherein the molten aluminum alloy is cooled within the shot chamber to a temperature range which produces a range of 40% to 60% solid to form the semi-solid slurry.

15. A method as defined in claim 12 wherein the molten aluminum alloy is A356 aluminum alloy and is cooled within the shot chamber to a temperature within the range of 570°C to 590°C to form the semi-solid slurry.

16. A method as defined in claim 12 wherein the gate opening is located to receive the semi-solid slurry within only a center portion of the shot chamber and to avoid receiving more solid slurry within an outer portion of the shot chamber.

17. A method as defined in claim 12 and including the step of directing the molten aluminum alloy into a second shot chamber receiving a second shot piston, interchanging the second shot chamber and piston with the first shot chamber and piston after the semi-solid slurry is transferred from the first shot chamber into the die cavity, and cooling the molten aluminum alloy within the second shot chamber to within the temperature range forming the semi-solid slurry.

18. A method as defined in claim 12 wherein the molten aluminum alloy is cooled within a shot chamber having a diameter substantially larger than its depth.

19. A method as defined in claim 12 wherein the molten aluminum alloy is cooled to form a semi-solid slurry within a shot chamber having a diameter of at least six inches.

20. A method as defined in claim 10 wherein the molten aluminum alloy is cooled within the shot chamber to a temperature within the range of 570°C to 590°C to form the semi-solid slurry.

21. A method of producing a high strength metal alloy part within a die cavity defined by a die set mounted on a vertical die cast press including a cylindrical shot chamber having a generally vertical axis and a shot piston movable axially within the chamber and wherein the diameter of the shot chamber is greater than an injection stroke of the shot piston, the method comprising the steps of heating a solid metal alloy to form a molten metal alloy, directing the molten metal alloy into the shot chamber, cooling the molten metal alloy within the shot chamber to a temperature within a predetermined temperature range to form a semi-solid slurry having a globular, and generally non-dendritic microstructure, moving the

shot piston upwardly to transfer the semi-solid slurry from the shot chamber through a gate opening into the die cavity, and allowing the semi-solid slurry to solidify within the die cavity to form the metal alloy part.

22. A method as defined in claim 21 and including the step of adding a grain refiner material to the molten metal alloy directed into the shot chamber.

23. A method as defined in claim 21 including the steps of forming an annular entrapment recess above the shot chamber, and trapping a an outer portion of the semi-solid slurry within the shot chamber within the entrapment recess in response to upward movement of the shot piston.

24. A method as defined in claim 21 wherein the molten metal alloy is cooled within the shot chamber to a temperature range which producers a range of 40% to 60% solid to form the semi-solid slurry.

25. A method as defined in claim 21 wherein the molten metal alloy is A356 aluminum alloy and is cooled within the shot chamber to a temperature within the range of 570°C to 590°C to form the semi-solid slurry.

26. A method as defined in claim 21 and including the step of directing the molten metal alloy into a second shot chamber receiving a second shot piston, interchanging the second shot chamber and piston with the first shot chamber and piston after the semi-solid slurry is transferred from the first shot chamber into the die cavity, and cooling the molten metal alloy within the second shot chamber to within the predetermined temperature range to form the semi-solid slurry.

27. A method as defined in claim 21 wherein the molten metal alloy is cooled to form a semi-solid slurry within a shot chamber having a diameter of at least six inches.